U.S. Department of Energy
Technical Qualification Program

Occupational Safety Qualification Standard

Study Guide

For the

Chemical Processing Qualification Standard

April 1996

Competency 1.10 **Chemical Processing personnel shall demonstrate a familiarity level knowledge of the requirements for using personal protective equipment (PPE).**

1. Supporting Knowledge and Skills

a. Describe the principles governing the selection, use and limitations of the following:
- Respirators
- Protective clothing
- Hearing protection devices

b. Describe the various types of personal equipment (devices or clothing) worn to protect a worker from chemical exposure, radiological exposure, and physical injury.

2. Self-Study Activities (corresponding to the intent of the above competency)

NOTE: Below are three web sites containing many of the references you may need.

Web Sites		
Organization	**Site Location**	**Notes**
Department of Energy	http://cted.inel.gov/cted/index.html	DOE Standards, Guides, and Orders.
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

Read 29 CFR 1910 Subpart I, *Personal Protective Equipment*, and 29 CFR 1910.120 Appendix B, *General Description and Discussion of the Levels of Protection and Protective Gear*.

EXERCISE 1.10-A What are the two basic objectives of any personal protective equipment (PPE) program?

EXERCISE 1.10-B Referring to paragraph (a) of 29 CFR 1910 Subpart I, *Personal Protective Equipment*, when shall personal protective equipment be

provided and used?

EXERCISE 1.10-C Referring to 29 CFR 1910 Subpart I *Personal Protective Equipment,* and to 29 CFR 1910.120 Appendix B, *General Description and Discussion of the Levels of Protection and Protective Gear*, what are the areas of the human body that are afforded protection by personal protective equipment (PPE)?

Read Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*

EXERCISE 1.10-D Referring to Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the primary and secondary considerations when selecting protective clothing?

EXERCISE 1.10-E Referring to Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, describe the intended purpose of the personal protective equipment (PPE) listed in the following table:

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part Protected	**PPE**	**Purpose**
Eyes and face	Face shield	
	Splash hood	
	Safety glasses	
	Goggles	
	Sweat bands	
Respiratory	Self-contained breathing apparatus	

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part Protected	**PPE**	**Purpose**
	Supplied-air respirators	
	Air-purifying respirators	
Hands and arms	Gloves and sleeves	
Feet	Safety boots	
	Disposable shoe or boot covers	
Head	Safety helmet	
	Hood	
	Protective hair covering	
Full body	Fully encapsulating suit	
	Nonencapsulating suit	
	Aprons, leggings, and sleeve protectors	

3. Summary

The control of occupational health hazards requires that an employee's exposure to harmful chemical agents, physical stresses, and physical agents does not exceed permissible levels. The variables or quantities of interest that must be measured are the concentration or intensity of the particular hazard and the duration of exposure.

The types of hazard control measures to be installed depend on the nature of the harmful

substance or agent and its routes of entry or absorption into the body. An employee's exposure to an airborne substance is related to the amount of contaminants in the breathing zone and the time interval during which an employee is exposed to this concentration. Reducing the amount of contaminant in the employee's breathing zone or the amount of time that an employee spends in the area will reduce the overall exposure.

Various methods of control available are broken down into these categories:

- *Engineering controls* that eliminate the hazard, either by initial design specifications or by applying methods of substitution, isolation, or ventilation.
- *Administrative controls* that restrict employees' exposures by scheduling reduced work times in contaminated areas, and by other work rules.
- *PPE* that should be considered a method of last resort when engineering controls are not sufficient to achieve acceptable limits of exposure. PPE can be used in conjunction with engineering and administrative controls, and with other methods.

The specific application of these controls, used according to the hazard involved, is dictated the Code of Federal Regulations.

4. Exercise Solutions

EXERCISE 1.10-A What are the two basic objectives of any personal protective equipment (PPE) program?

ANSWER 1.10-A
1. To protect the wearer from safety and health hazards.
2. To prevent injury to the wearer from incorrect use and/or malfunction.

EXERCISE 1.10-B Referring to paragraph (a) of 29 CFR 1910 Subpart I, *Personal Protective Equipment*, when shall personal protective equipment be provided and used?

ANSWER 1.10-B (Any reasonable paraphrase of the following:) "Whenever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact."

EXERCISE 1.10-C Referring to 29 CFR 1910 Subpart I *Personal Protective Equipment,* and to 29 CFR 1910.120 Appendix B, *General Description and Discussion of the Levels of Protection and Protective Gear,* what are the areas of the human body that are afforded protection by personal protective equipment (PPE)?

ANSWER 1.10-C

- Full body
- Head
- Eyes and face
- Ears
- Hands and arms
- Feet
- Respiratory system

EXERCISE 1.10-D Referring to Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the primary and secondary considerations when selecting protective clothing?

ANSWER 1.10-D

Primary:

- permeation
- degradation
- penetration
- heat transfer

Secondary:

- durability
- flexibility
- temperature effects
- ease of decontamination
- compatibility with other personal protective equipment
- duration of use

EXERCISE 1.10-E Referring to Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, in the following table complete the intended purpose of the listed types of personal protective equipment (PPE).

ANSWER 1.10-E

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part Protected	**PPE**	**Purpose**
Eyes and face	Face shield	Protects against chemical splashes.
	Splash hood	Protects against chemical splashes.
	Safety glasses	Protect eyes against large particles and projectiles.
	Goggles	Can protect against vaporized chemicals, splashes, large particles, and projectiles.
	Sweat bands	Prevent sweat-induced eye irritation and vision impairment.
Respiratory	Self-contained breathing apparatus	Provides the highest available level of protection against airborne contaminants and oxygen deficiency.
	Supplied-air respirators	Protect against most airborne contaminants and permitted for use in oxygen-deficient atmospheres.
	Air-purifying respirators	Protect against specific chemicals and particulates up to specific concentrations.
Hands and arms	Gloves and sleeves	Protect hands and arms from chemical contact.
Feet	Safety boots	Protect feet from contact with chemicals and from compression, crushing, or puncture by falling, moving, or sharp objects.
	Disposable shoe or boot covers	Protect safety shoes or boots from contamination.

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part Protected	**PPE**	**Purpose**
Head	Safety helmet	Protects head from blows.
	Hood	Protects against chemical splashes, particulates, and rain.
	Protective hair covering	Protects hair against chemical contamination, entanglement in machinery or equipment, or from interfering with vision and with the functioning of respiratory devices.
Full body	Fully encapsulating suit	Protects against splashes, dust, gases, and vapors.
	Nonencapsulating suit	Protects against splashes, dust, and other materials, but not against gases and vapors.
	Aprons, leggings, and sleeve protectors	Provide additional splash protection of chest, forearms, and legs.

Competency 2.9 **Chemical processing personnel shall demonstrate the ability to evaluate the adequacy of local compliance with the following sections of 29 CFR 1910, Occupational Safety and Health Standards:**

- **1910.119, Process Safety Management of Highly Hazardous Chemicals**
- **1910.120, Hazardous Waste Operations and Emergency Response**
- **1910.1200, Hazard Communication**

1. Supporting Knowledge and Skills

a. Describe the purpose, scope, and application of the listed regulations.

b. Discuss what constitutes an acceptable contractor work performance with the requirements of the above regulations.

c. Discuss the process by which Department line management determines an appropriate level of coverage by chemical processing personnel. Include in this discussion factors that may influence the level of coverage.

d. Using the appropriate regulation, assess the adequacy of training on HAZCOM in the following areas:
   - Methods and observations to detect the presence or release of hazardous chemicals
   - Physical and health hazards of chemicals in the workplace
   - Measures employees can take to protect themselves
   - Use of information contained on labels and Material Safety Data Sheets

e. Given data from an evaluation, analyze the results of the evaluation to determine contractor compliance or noncompliance with the requirements.

f. Discuss the purpose of the Process Hazard Assessment.

2. Self-Study Activities (corresponding to the intent of the above competency)

NOTE: Below are three web sites containing many of the references you may need.

Web Sites		
Organization	**Site Location**	**Notes**
Department of Energy	http://cted.inel.gov/cted/index.html	DOE Standards, Guides, and Orders.
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

Read the purpose, scope, and application sections of 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication; of 29 CFR 1910, Occupational Safety and Health Standards.

EXERCISE 2.9-A Describe the purpose, scope, and application sections of 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication.

EXERCISE 2.9-B Referring to the requirements of 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication, discuss what constitutes acceptable contractor work performance with regard to performance attributes and programmatic requirements.

EXERCISE 2.9-C Identify five factors that may influence department line management's determination of an appropriate level of workplace coverage by chemical processing personnel.

EXERCISE 2.9-D Referring to 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication of 29 CFR 1910, Occupational Safety and Health Standards, what are the significant indicators used to determine the adequacy of the following aspects of Hazard Communication (HAZCOM) training:

- Methods and observations to detect the presence or release of hazardous chemicals
- Physical and health hazards of chemicals in the workplace
- Measures employees can take to protect themselves
- Use of information contained on labels and Material Safety Data Sheets

EXERCISE 2.9-E As a participant on an Occupational Safety and Health Act (OSHA) compliance assessment team, what are the elements of training that you'll review when comparing the facility operator/contractor's performance in training with the HAZCOM training requirements noted in 1910.119, Process Safety Management of Highly Hazardous Chemicals, 1910.120, Hazardous Waste Operations and Emergency Response, and 1910.1200, Hazard Communication, of 29 CFR 1910, Occupational Safety and Health Standards? As necessary, refer to DOE-STD-1070-94, Guidelines for Evaluation of Nuclear Facility Training Programs.

Read pages 1 through 7 and Appendices 2 and 5 of DOE-STD-1048-92, DOE Performance Indicators Guidance Document.

EXERCISE 2.9-F Given data from the above assessment and referring to DOE-STD-1048-92, how should you analyze the results to determine contractor compliance or noncompliance with the requirements, and compare them to DOE's current performance indicators?

Read 29 CFR 1910, Occupational Safety and Health Standards, 1910.119, Process Safety Management of Highly Hazardous Chemicals, Appendix C, Compliance Guidelines and Recommendations for Process Safety Management.

EXERCISE 2.9-G Referring to Appendix C, Compliance Guidelines and Recommendations for Process Safety Management, of 1910.119, Process Safety Management of Highly Hazardous Chemicals, of 29 CFR 1910, Occupational Safety and Health Standards, discuss the purpose of the Process Hazard Assessment.

3. Summary

The general purpose of the three significant sections of 29 CFR 1910, Occupational Safety and Health Standards (1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication), is to ensure that hazardous material in the workplace is identified, analyzed, and controlled.

Since the degree of hazard depends on both the level or concentration and duration of exposure, the hazard and associated processes must be analyzed to determine if there are additional hazards and what controls need to be implemented. Unless there is specific information that the process is adequately controlled, there are types of industrial operations that should immediately alert the health and safety professional to a potential health hazard. (From *Fundamentals of Industrial Hygiene*, pp. 398-400.)

To ensure that all actual and potential hazardous material is identified and controlled onsite, both DOE and the contractor must acknowledge and implement the requirements of 29 CFR 1910. Acceptable contractor performance is demonstrated by generic performance attributes such as planning and preparedness, regular self-assessments, and quality assurance; and the fulfillment of programmatic requirements (from 1910.119. 1910.120, and 1910.1200) such as employee training and information programs, emergency response programs, personal protective equipment for employee protection, and monitoring for actual and potential hazardous materials. Workplace coverage of chemical processing personnel is another demonstration of contractor performance, and is typically based on the nature of the hazard, magnitude or concentration of the hazard, duration of exposure, accessibility of the hazardous material process operations, and availability of the personnel.

Adequacy of contractor performance, particularly with regard to training, is measured by various training effectiveness indicators, which include review of the content of the lesson plans and their organizational level of approval, demonstrated ability in the workplace, and the supervisor's assessment of the worker's ability. Further, a compliance audit of a training program for chemical processing personnel would take a more comprehensive look at training operations. This audit typically includes the review of the management and administration of

the training and qualification program, the qualification of instructors, the determination of training content, the training examinations, and how the facility evaluates the training program. The resulting data gathered from the audit is used to determine whether the facility is complying with the specified 29 CFR 1910 requirements. These data are sorted by OSHA Standards requirement, assessed if there are enough data for each requirement to support a sound decision, and then compared with the requirement. The audit team then determines if the requirement is fulfilled by the data, prepares a basis or justification statement for the decision, compiles the decision, and prepares a report of the assessment results.

4. Exercise Solutions

EXERCISE 2.9-A Describe the purpose, scope, and application sections of 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication.

ANSWER 2.9-A (Any reasonable paraphrase of the following is acceptable.)

29 CFR 1910 Standards			
Standard	**Purpose**	**Scope**	**Application**
1910.119, "Process Safety Management of Highly Hazardous Chemicals"	To establish requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. These releases may result in toxic, fire, or explosion hazards.	Any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the onsite movement of such chemicals, or combination of these activities.	A process that involves a chemical at or above the specified threshold quantities, or a process that involves a flammable liquid or gas onsite in one location, in a quantity of 10,000 pounds or more (with exceptions - see Std.).

29 CFR 1910 Standards			
Standard	**Purpose**	**Scope**	**Application**
1910.120, "Hazardous Waste Operations and Emergency Response"	To establish requirements for operators of hazardous waste and for emergency response. This entails establishment of safety and health programs; site characterization and analysis; site control; training; medical surveillance; engineering controls, work practices, and personal protective equipment for employee protection; monitoring; information programs; handling drums and containers; decontamination; emergency response by employees; emergency response to hazardous substance releases; and new technology programs.	Unless the employer can demonstrate that the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards, this standard covers required cleanup operations, required corrective actions involving clean-up, voluntary cleanup operations, hazardous waste operations, and emergency response operations.	All requirements of 29 CFR 1910 & 1926 apply to hazardous waste and emergency response operations. If there is a conflict or overlap, the provision more protective of employee safety and health applies.
1910.1200, "Hazard Communication"	To ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning the hazards is transmitted to employers and employees.	Chemical manufacturers or importers are required to assess the hazards of chemicals that they produce or import, and all employers are required to provide information to their employees about the hazardous chemicals, by means of hazard communication, labels, material safety data sheets, and information and training.	To any chemical that is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

EXERCISE 2.9-B Referring to the requirements of 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication, discuss what constitutes acceptable contractor work performance with regard to performance attributes and programmatic requirements.

ANSWER 2.9-B (Any reasonable paraphrase of the following is acceptable.)

Simply stated, acceptable contractor work performance is that performance which fulfills the intent and the requirements of the 29 CFR 1910 standards. More specifically, the contractor's work performance must reflect the following attributes and satisfy the programmatic requirements of each standard:

Acceptable Contractor Work Performance with 29 CFR 1910

Performance Attributes	Programmatic Requirements
• Preplanning and preparedness • Continuous improvement • Management and staff ownership • Vigilance • Regular self-assessments • Problem and root-cause analyses • Corrective actions and follow-up • Welcoming constructive criticism • Prevention • Change management • Quality assurance • Professional honesty and integrity	1910.119: Employee participation; process safety information; process hazard analysis; operating procedures; training; subcontractors; pre-startup safety review; mechanical integrity; hot work permit; incident investigation; emergency planning and response; compliance audits. 1910.120: Safety and health programs; site characterization and analysis; site control; training; medical surveillance; engineering controls, work practices, and personal protective equipment for employee protection; monitoring; information programs; handling drums and containers; decontamination; emergency response by employees; emergency response to hazardous substance releases; certain RCRA operations; new technology programs. 1910.1200: Hazard determination; written hazard communication; labels and other forms of warning; Material Safety Data Sheets; employee information and training; trade secrets.

EXERCISE 2.9-C Identify five factors that may influence department line management's determination of an appropriate level of workplace coverage by chemical processing personnel.

ANSWER 2.9-C (Any five of the following is acceptable.)

Generally, chemical processing worker coverage in the workplace is determined by line management based on the following factors:

- Nature of the hazard
- Magnitude of exposure or potential exposure
- Duration of the exposure
- Number of workers affected by exposure to the hazard
- Workers' susceptibility
- Availability of qualified chemical processing personnel
- Accessibility of the hazardous material process operations
- Shift schedules
- Job priority
- Regulatory requirements
- Requirements of the facility safety analysis report or of the technical specification document

EXERCISE 2.9-D Referring to 1910.119, Process Safety Management of Highly Hazardous Chemicals; 1910.120, Hazardous Waste Operations and Emergency Response; and 1910.1200, Hazard Communication, of 29 CFR 1910, Occupational Safety and Health Standards, what are the significant indicators used to determine the adequacy of the following aspects of Hazard Communication (HAZCOM) training:

- Methods and observations to detect the presence or release of hazardous chemicals
- Physical and health hazards of chemicals in the workplace
- Measures employees can take to protect themselves
- Use of information contained on labels and Material Safety Data Sheets

ANSWER 2.9-D (Any reasonable paraphrase of the following is acceptable.)

HAZCOM Training	
Aspect	**Indicators of Adequacy**
Methods and observations to detect the presence or release of hazardous chemicals	• Specific lesson plan, approved by subject matter expert and line management • Demonstrated ability in the workplace • Supervisor's assessment of worker's ability • Assessment of own ability • Timely and accurate detection of hazardous material in the workplace
Physical and health hazards of chemicals in the workplace	• Specific lesson plan, approved by subject matter expert and line management • Demonstrated knowledge • Supervisor's assessment of worker's knowledge • Assessment of own knowledge
Measures employees can take to protect themselves	• Specific lesson plan, approved by subject matter expert and line management • Demonstrated ability in the workplace • Supervisor's assessment of worker's ability • Assessment of own ability • Timely and accurate deployment in the workplace
Use of information contained on labels and Material Safety Data Sheets	• Specific lesson plan, approved by subject matter expert and line management • Demonstrated use in the workplace • Supervisor's assessment of worker's ability to use • Assessment of own ability to use • Timely, appropriate, and accurate usage in the workplace

EXERCISE 2.9-E As a participant on an Occupational Safety and Health Act (OSHA) compliance assessment team, what are the elements of training that you'll review when comparing the facility operator/contractor's performance in training with the HAZCOM training requirements noted in 1910.119, Process Safety Management of Highly Hazardous Chemicals, 1910.120, Hazardous Waste Operations and Emergency Response, and 1910.1200, Hazard Communication, of 29 CFR 1910, Occupational Safety and Health Standards? As necessary, refer to DOE-STD-1070-94.

ANSWER 2.9-E (Any reasonable paraphrase of the following is acceptable.)

- Employee population selected for training
- Stated goals for training
- Content of the training
- Schedule
- Measurement of success and effectiveness
- Instructor qualification process
- Instructors' qualifications
- Problem identification and corrective action process

EXERCISE 2.9-F Given data from the above assessment and referring to DOE-STD-1048-92, how should you analyze the results to determine contractor compliance or noncompliance with the requirements, and compare them to DOE's current performance indicators?

ANSWER 2.9-F (Any reasonable paraphrase of the following is acceptable.)

Review the data collected, sort the data by OSHA Standards requirement, determine if there is enough data for each requirement to support a sound decision, compare the data with the requirement, determine if the requirement is fulfilled by the data, prepare a basis or justification statement for the decision, compile the decisions and prepare a report of the assessment results. Now compare the results of the assessment with the applicable DOE and site-specific performance indicators: personnel safety, operational incidents, environment, and management.

EXERCISE 2.9-G Referring to Appendix C, Compliance Guidelines and Recommendations for Process Safety Management, of 1910.119, Process Safety Management of Highly Hazardous Chemicals, of 29 CFR 1910, Occupational Safety and Health Standards, discuss the purpose of the Process Hazard Assessment.

ANSWER 2.9-G (Any reasonable paraphrase of the following is acceptable.)

The process hazard assessment (PHA) is an organized and systematic effort to identify and analyze the significance of potential hazards associated with the processing or handling of highly hazardous chemicals. The results are used by employers and employees to make decisions to improve safety and to reduce the consequences of unwanted or unplanned releases of hazardous chemicals. The PHA focuses on equipment, instrumentation, utilities, human actions, and external factors that might impact the process.